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1. Epidermis.
2. The proper fibrous layer, composed of—
 - a. The lamina of radiating fibres.
 - b. The lamina of circular fibres.
3. Mucous membrane.

One of the principal objects of the paper is to describe the structure and functions of the fibrous laminæ. Since the time of Sir Everard Home, who pronounced the layer of radiating fibres to be muscular, anatomists have differed in their views of the nature of the fibrous element of the membrana tympani. The lamina of radiating fibres, the outer surface of which is covered by the epidermis, is described as continuous with the periosteum of the external meatus. With the exception of the uppermost fibres, which on account of their being somewhat flaccid have been considered as a separate tissue under the name of "membrana flaccida," the radiate layer is composed of fibres which extend from the circular cartilaginous ring to the malleus, and they interlace in their course. These fibres are from the 4000th to the 5000th part of an inch in breadth.

The lamina of circular fibres consists of circular fibres, which are firm and strong towards the circumference, but very attenuated towards the centre. These fibres are so attached and arranged as to form a layer of membrane, which in a quiescent state is saucer-shaped. The fibres composing the circular are smaller than those of the radiate lamina, being from the 6000th to the 10,000th part of an inch in breadth.

The facts that appear to be adverse to the idea of the fibres of either layer being muscular are—

1. The absence of distinct nuclei in the fibres.
2. Their great denseness and hardness.

It is next shown that the four laminæ forming the membrana tympani are continuous with other structures, of which they appear to be mere modifications, and that not one is proper to the organ.

The tensor tympani ligament, which had not been previously noticed by anatomists, is particularly described; it is attached externally to the malleus, close to the insertion of the tensor tympani muscle, and internally to the cochleariform process.

The latter part of the paper is occupied by observations on the functions of the fibrous laminæ and of the tensor ligament of the membrana tympani; and it is shown that by these two antagonistic forces, the one tending to draw the membrana tympani inwards, the other outwards, this organ is maintained in a state of moderate tension, and is always in a condition to receive ordinary sonorous undulations.

6. "Investigations into the Structure and Development of the Scales and Bones of Fishes." By W. C. Williamson, Esq. Communicated by W. B. Carpenter, M.D., F.R.S.

In this memoir the author first points out the discrepancies that exist between the opinions of M. Mandl and M. Agassiz respecting the structure and growth of cycloid and ctenoid scales; and after

referring to the peculiar views entertained by each of these ichthyologists, he enters upon the investigation of a number of examples, including the Carp, Perch, Gray Mullet, Pike, Salmon, and especially the large scale of an unknown fish from the Bay of Dulse on the western coast of Mexico. The results of this inquiry lead the author to conclusions which differ considerably from those of both M. Agassiz and M. Mandl. He points out the existence of *three* distinct vertically-disposed structures in each of these scales; a lower one, consisting of membranous *laminæ*; a middle calcareous one, having a very peculiar structure and growth; and an upper one, also calcareous, but very distinct from the last, and which is variously disposed in different scales. In all it contributes the peculiar cycloid and other markings which ornament their surfaces; whilst in ctenoid scales, isolated portions of it appear to form the characteristic teeth which project from their posterior margins.

The author then develops in succession the peculiar and beautiful structures seen in the scales of *Dactylopterus*, *Balistes*, *Loricaria*, and various forms belonging to the Ostracian group. Whilst these examples exhibit singular diversities of structure, they appear to be all modified forms of one common type.

From this branch of the inquiry the author proceeds to examine the other calcareous tissues existing in fishes, commencing with the endo-skeletons of the Sharks and Rays (*Plagiostomes*). He shows that the entire osseous elements of these vertebrates are constructed of a peculiar form of bone, which he designates "chondriform," being wholly developed either within the soft tissues of true cartilage, or of a modified form of cartilage. Fossil remains, having the same structure, have been found in the lias at Lyme Regis and in the coal-measures near Manchester and Leeds. He then examines in succession a number of the bones of the Common Pike, and shows that whilst all the osseous elements of these skeletons are developed in connexion with a cartilaginous matrix, their tissues are of two kinds, which remain permanently distinct. One of these is of the same chondriform character as that seen in the *Plagiostomes*, being developed in the interior of the cartilage; the other, which is produced either at the outer surface of the cartilage or in cavities left by the absorption of the latter tissue, the author terms "membraniform," being formed within the lamellæ of a fibrous membrane, of which the primary origin is doubtful. The peculiar relations which these various structures bear to one another in the different stages of growth are explained. The same process of inquiry is applied to many of the bones of the Perch, Cod, Haddock, Sharp-nosed Eel, Salmon, &c., in each of which peculiarities exist. In the latter example especially the entire skeleton consists of a modified form of chondriform bone, of which it exhibits two kinds. One of these resembles that of the Pike and other examples, both in its aspect and in the situations in which it occurs. The second form is more peculiar; whilst the way in which its growth is accomplished closely resembles that of membraniform bones produced by the calcification of fibrous periosteal membranes, its internal structure

shows that it is of the chondriform type, being developed in a thick leathery periosteum of fibro-cartilage, and which appears to be continuous with the true cartilage wherever the two come into contact.

It is not possible to give any definite idea of the detailed observations contained in a memoir of which so large a portion is devoted to minute investigation. The inferences which the author deduces from his facts are given in connexion with each of the several topics discussed; and in the concluding portion of the memoir he points out the bearing which they have upon some general questions in physiology. A close resemblance is shown to exist between the processes of calcification, as carried on in the fibrous tissues of fish-scales, in cartilages and in fibro-cartilages, in all of which the phenomena closely correspond; and the author thinks that the bones and teeth of mammals, in which the process is far less obvious than in these ichthyal structures, may be calcified in a similar way.

The important bearing of the membraniform kosmine structures (which closely resemble the different varieties of dentine) upon the generally received hypothesis respecting the growth of teeth is also discussed; and the author thinks there are such sufficient reasons for doubting the correctness of that hypothesis, as to render a review of the evidence upon which it is based very desirable.

The peculiar modifications which the homologues of the Haversian canals of anthropotomists present amongst different groups of fishes are pointed out, as well as the very near affinity which exists between bone, dentine, ganoin, kosmine, enamel; and the probability of a closer relationship between cartilage, fibro-cartilage and fibrous periosteum, is also suggested as a subject deserving further investigation. The field opened out to the physiologist and the microscopist in the department of ichthyology is almost boundless, being comparatively unexplored, whilst it promises a rich harvest to those who labour in it.

7. "On the Impregnation of the Ovum in the Amphibia." By George Newport, F.R.S., F.L.S. &c.

The author states that this communication to the Royal Society is part of a series of investigations on development, on which he has been for some years engaged, and which was commenced in a paper on that of the Myriapoda, published in 1841, in the Philosophical Transactions. The plan followed in these investigations has been to combine observations on the natural history of the animals with others on the conditions which affect their development, as the best mode of arriving at correct conclusions. The history of the discovery of what can now be proved to be the direct agent of impregnation, the spermatozoon, is then traced; and it is shown, that although within the last few years an opinion has been gaining ground that the spermatozoon, and not the *liquor seminis*, as formerly supposed, is the means of impregnation, no acknowledged proof has hitherto been given of the correctness of this opinion, and no refutation afforded to the theory that the *liquor seminis* is the part of the seminal fluid immediately concerned. The question of